CITY OF HALLANDALE
DRAINAGE COMPUTATIONS

The City of Hallandale Code of Ordinance (Chapter 32, Section 32-885) requires all new development or redevelopment to retain, on-site, the volume of runoff generated during a 5-year, 1-hour storm. The amount of rainfall produced during such a storm is 3.3 inches. New commercial and residential development must meet this drainage requirement in addition to any other requirements set forth by Broward County Department of Natural Resource Protection (BC-DNRP) and the South Florida Water Management District (SFWMD).

In order to help small residential developments *(single family units and duplexes)* the City's Engineering Division has developed a worksheet to aid applicants in determining the volume of runoff generated during a 5-year, 1-hour storm. The calculations follow the methodology recommended by the SFWMD in their publication "Management and storage of surface Waters, permit Information Manual, Volume 4." **Applicants may include the calculations on this worksheet with their permit application.** It must be noted that if the site is subdivided in two or more sub-basins, calculations for each sub-basin must be submitted. These calculations must be performed by a registered professional engineer or a registered architect.

Once the volume of runoff generated during a 5-year, 1-hour storm within the property or a sub-basin within the property is determined, the applicant must include calculations showing this volume will be contained within the property or the sub-basin within the property. Retention of this volume can be provided within shallow retention ponds (4"–12" deep or as deep as necessary), swales, or drains.

The applicant must also provide plans showing existing and proposed elevations throughout the property (and sub-basins, if applicable) demonstrating the volume of runoff generated during the design storm (5-year, 1-hour) will be contained within the retention areas. The existing and proposed elevations must also show no overflow from the property or sub-basin within the property will occur to adjacent properties or Right-Of-Ways during a 5-year, 1-hour storm.

PROJECT NAME: _____   PERMIT No. _____

                                                     DATE: _____

CITY OF HALLANDALE DRAINAGE COMPUTATIONS WORKSHEET

Definitions:

P: Rainfall depth in inches.

S: Soil storage capacity in inches.

R: Runoff depth in inches.

A: Total area of property or sub-basin within property in square feet

AI: Total area of roof, pavement, and walkways within property or sub-basin within in square feet.

AP: Total pervious areas within property or sub-basin within property in square feet.

V: Volume of run-off in cubic feet.

Step 1

Determine A

A = _____ square feet

Step 2

Determine AP and AI

AP = _____ square feet

AI = _____ square feet

Step 3

Determine the average NGVD elevation of pervious areas within property or sub-basin within property.

Average Elevation of Pervious Areas = _____ feet NGVD

Step 4

Determine the distance between the average high ground water elevation and the average elevation of pervious areas. For design purposes, the average high ground water elevation for most of Hallandale is 2 feet NGVD.

Distance = _____ feet

Step 5

Determine an S_1 value from the table below:

Distance between groundwater table and average elevation of pervious areas	S_1
1 foot	0.45 inch
2 feet	1.88 inches
3 feet	4.95 inches
4 feet	8.18 inches
>4 feet	8.18 inches

If necessary, compute a value of S_1 by interpolation.

S_1 = _____ inches

Step 6

Determine S as:

$$S = \frac{AP}{A} * S_1$$

S is computed in inches

S = _____ inches

Step 7

Determine runoff depth (R) as:

$$R = \frac{(P - 0.2 * S)^2}{(P + 0.8 * S)}$$

Where P=3.3 inches. Then:

$$R = \frac{(3.3 - 0.2 * S)^2}{(3.3 + 0.8 * S)}$$

R is computed in inches

R = _____ inches

Step 8

Determine volume of runoff as:

$$V = A * \frac{R}{12}$$

V is computed in cubic feet

V is the volume of runoff generated during a 5-year, 1-hour storm within the property or the sub-basin within the property. This is the volume of runoff that must be contained within the property.

V = _____ cubic feet

Step 9

Compute " retention volume provided" (VP) as the retention volume capacity, in cubic feet, of swales, retention areas, and drains within property or sub-basin within property.

**Attach calculations showing how this volume was computed.
**Calculations must be consistent with existing and proposed elevation shown on design plans.

$$VP = \underline{\hspace{2cm}} \text{ cubic feet}$$

Step 10

Compare values of retention volume provided (VP in Step 9) with retention volume needed (V in Step 8). Retention volume provided (VP) must be larger than retention volume needed (V)

$$(VP = \underline{\hspace{2cm}} \text{ cubic feet}) > (V = \underline{\hspace{2cm}} \text{ cubic feet})$$

NOTE: These volume calculations are needed to satisfy the City of Hallandale code requirements. Other agencies may require larger retention volumes.

PROJECT NAME: *John Doe's Single Family*   PERMIT No. *99-XYZ*
                123 Any Street   DATE: *4/23/99*

CITY OF HALLANDALE DRAINAGE COMPUTATIONS WORKSHEET

Definitions:

P: Rainfall depth in inches.

S: Soil storage capacity in inches.

R: Runoff depth in inches.

A: Total area of property or sub-basin within property in square feet

AI: Total area of roof, pavement, and walkways within property or sub-basin within in square feet.

AP: Total pervious areas within property or sub-basin within property in square feet.

V: Volume of run-off in cubic feet.

Step 1

Determine A

> A = *6,000*   square feet

Step 2

Determine AP and AI

> AP = *4,378*   square feet

> AI = *1,620*   square feet

Step 3

Determine the average NGVD elevation of pervious areas within property or sub-basin within property.

> Average Elevation of Pervious Areas = *5.5*   feet NGVD

Step 4

Determine the distance between the average high ground water elevation and the average elevation of pervious areas. For design purposes, the average high ground water elevation for most of Hallandale is 2 feet NGVD.

5.5' – 2' = 3.5'

Distance = ___3.5___ feet

Step 5

Determine an S_1 value from the table below:

Distance between groundwater table and average elevation of pervious areas	S_1
1 foot	0.45 inch
2 feet	1.88 inches
3 feet	4.95 inches
4 feet	8.18 inches
>4 feet	8.18 inches

If necessary, compute a value of S_1 by interpolation.
Distance = 3.5 feet; interpolating between 3 feet and 4 feet:

S_1 = ___6.57___ inches

Step 6

Determine S as:

$$S = \frac{AP}{A} * S_1 \rightarrow \frac{4,378}{6,000} * 6.57 = 4.8"$$

S is computed in inches

S = ___4.8___ inches

Step 7

Determine runoff depth (R) as:

$$R = \frac{(P - 0.2 * S)^2}{(P + 0.8 * S)}$$

Where P=3.3 inches. Then:

$$R = \frac{(3.3 - 0.2 * S)^2}{(3.3 + 0.8 * S)} \rightarrow \frac{(3.3 - 0.2 * 4.8)^2}{(3.3 + 0.8 * 4.8)} = 0.767"$$

R is computed in inches

$$\boxed{R = \quad 0.767 \quad \text{inches}}$$

Step 8

Determine volume of runoff as:

$$V = A * \frac{R}{12} \rightarrow 6{,}000 * \frac{0.767}{12} = 384\, ft^3$$

V is computed in cubic feet

V is the volume of runoff generated during a 5-year, 1-hour storm within the property or the sub-basin within the property. This is the volume of runoff that must be contained within the property.

$$\boxed{V = \quad 384 \quad \text{cubic feet}}$$

Step 9

Compute " retention volume provided" (VP) as the retention volume capacity, in cubic feet, of swales, retention areas, and drains within property or sub-basin within property.

**Attach calculations showing how this volume was computed. _(see attached plan)_
**Calculations must be consistent with existing and proposed elevation shown on design plans.

$$VP = \underline{\quad 400 \quad} \text{ cubic feet}$$

Step 10

Compare values of retention volume provided (VP in Step 9) with retention volume needed (V in Step 8). Retention volume provided (VP) must be larger than retention volume needed (V)

$$(VP = \underline{\quad 400 \quad} \text{ cubic feet }) > (V = \underline{\quad 384 \quad} \text{ cubic feet })$$
$$OK$$

NOTE: These volume calculations are needed to satisfy the City of Hallandale code requirements. Other agencies may require larger retention volumes.

PROJECT: JOHN DOE'S SINGLE FAMILY HOME
123 ANY STREET, HALLANDALE
PERMIT # 99-XYZ   APRIL 99

60'

6.00   6.00   6.00

5.60
×

× 5.70

6.00 ×

100'

30'

HOUSE

10'

× 5.50

4.50
×

40'

RETENTION AREA

5.50 ×

40'

5.50 ×

4.50
×

× 5.50

×6.00

40'

×6.00

WALKWAY

5.70
×

DRIVEWAY

20'

19'

18'

6.00   6.00

RIGHT-OF-WAY

4'   6.00

SIDEWALK

APRON

EDGE OF ROAD

℄

✳ TOTAL AREA: A
60'X100' = 6,000 FT² = A

✳ IMPERVIOUS AREA: AI
30'X40' + 18'X19' + 20'X4' =
=1,622 FT² = AI

✳ PERVIOUS AREA: AP
6,000 FT² − 1,622 FT² =
=4,378 FT² = AP

✳ AVERAGE ELEVATION OF
PERVIOUS AREAS:
5.5 FT N.G.V.D.

✳ VOLUME OF STORAGE
PROVIDED: VP
10'X40'X1' = 400 FT³ = VP

→ FLOW DIRECTION OF RUNOFF

CAD: STORMED